An Intelligent Authoring Tool for Non-Programmers Using the Informedia Video Library

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http://www.cs.cmu.edu/~silver

Project Goals

- Make *using* digital video significantly easier
  - As easy as re-using textual material
- Create integrated digital video tool
  - *Organize* video and other multi-media material
  - *Create* presentations of various kinds
    - Linear "movies"
    - Interactive with user choices and behaviors
- Aimed at novices
  - Fifth graders

Goals, cont.

- Support the full process
  - Not just the final editing
  - Help with early creative design
  - Brainstorming
- Prototyping at every stage
  - Can always see the emerging production
  - Placeholders (e.g. drawings) for incomplete parts
  - Supports *iterative development*

Project Just Started

- New start
- Funding started on September 1
- Reporting on plans, not results

SILVER

Simplifying

I nteractive

Layout and

Video

Editing and

Reuse.

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Leverage Informedia

- Leverage significant prior work
- Informedia will find appropriate videos
  - Use its extensive search mechanisms
  - Visualization of search results
- Informedia processes and characterizes video
  - Recognition and alignment of the audio
  - Label interesting features in the videos (e.g. faces)
  - Divide into segments (scene breaks)
  - Classify camera movements (pan, zoom, etc.)
  - *other image processing...*

Why is Video Editing Difficult?

- Much more difficult than text editing
- Video editors make you work frame by frame
  - Timeline view
- Text editors have higher-level features
  - Select by character, word, line, sentence, …
  - Intelligent selection of spaces and punctuation
  - Search and replace
- Goal: Provide higher-level features for video editing

Multiple Views

- *For source material and current production*
- *All inter-linked and kept consistent*
- Time line
  - *Multiple,* independent time lines when interactive
- Script
  - With room for annotations and links
- Lists, such as the people in each scene
- Storyboard
  - Supports early design phases
  - Sketches

More Views

- Outline View
  - Hierarchies
  - Organize into higher-level chunks
- Flowchart
- Subject Piles
  - Tabbed forms
  - Collect related material, such as all scenes at a certain location
- *others....*

Synthetic Graphics

- Overlay drawn graphical objects
- Point to or label items in the video
- Image processing will identify objects in the video
  - Graphics will stay attached if object moves

Authoring behaviors

- Needed for interactive productions
- Create by demonstration
  - Give *examples* of desired behaviors
- Using a more *natural* scripting language
  - Design the language using HCI principles

Behaviors by Demonstration

- Create simple behaviors by simply showing the stimulus and resulting actions
  - "When the user clicks here, then play this video."
- User does not need to learn the code
- Much research on *generalizing* the example
  - Run-time situation not identical to design time
  - E.g., to a dynamically computed *set* of objects

More Natural Scripting

- Programming is a human activity
- Use HCI principles & results to guide design
  - Empirical Studies of Programmers on what is hard
  - HCI guidelines like *Be consistent*, *Avoid errors*
    - E.g., In Visual Basic, to assign something you use =, unless it's an object, in which case you use Set and = "`foo = 15`" vs. "`Set foo = object`"
  - Surprisingly not used in prior designs for scripting

New Studies

- Studying what is more natural
- How people *naturally* express programming concepts and algorithms
- Specific issues of language design

One Example of Results

- **"And" used inconsistently**
  "Scores of 10,000 and up are extraordinary."

The men and women here raise your hands!

```
if is_man(x) and is_woman(x) then raise_hand(x);
```

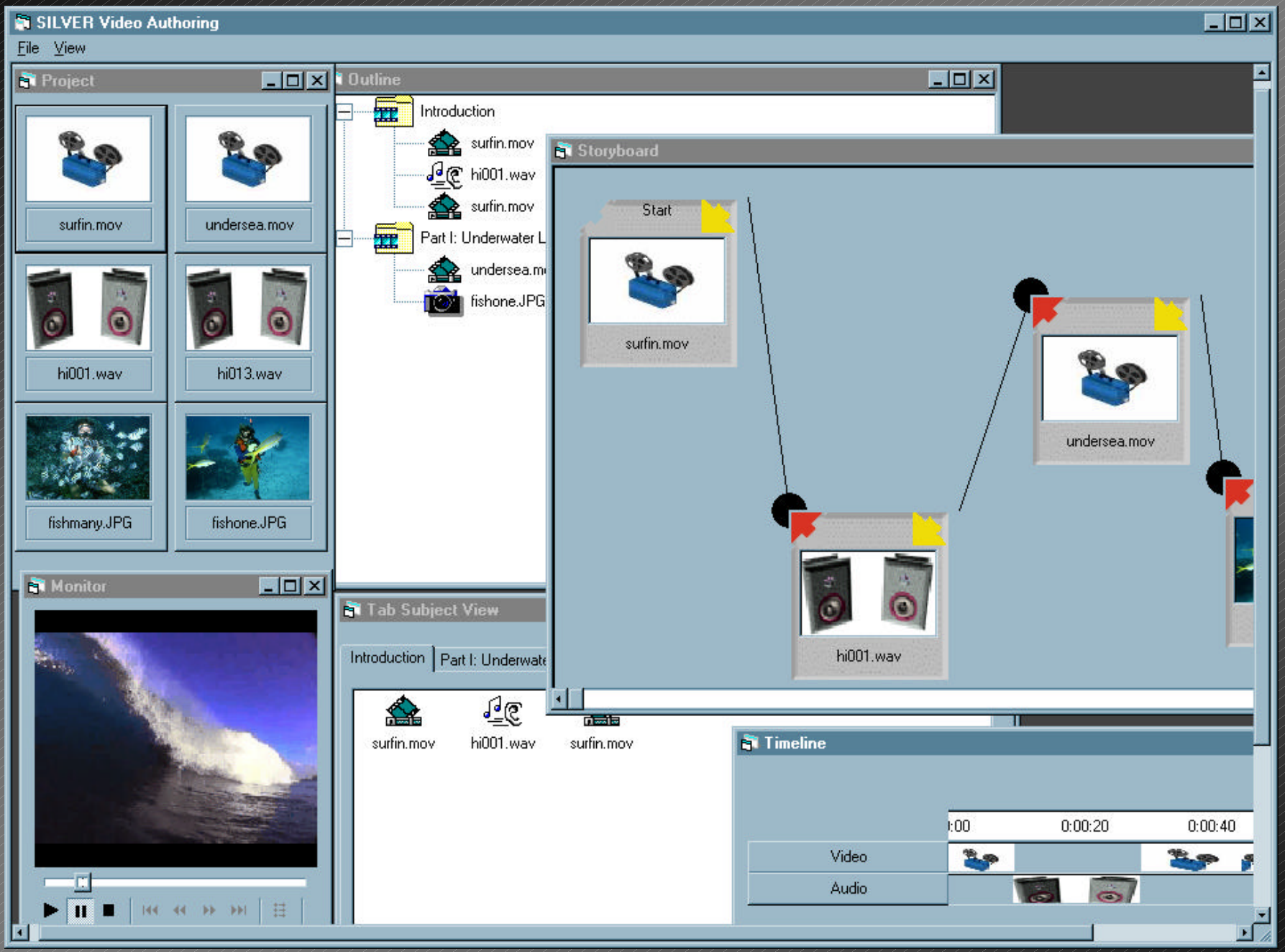
– This issue with "and" applies to other natural languages as well.

New Scripting Language

- Create a new scripting language that takes these results into account
- Aim for learnable, usable, and natural
- Create an entire environment
  - Not just a language

Current Status

- Already have minimal functionality to reuse existing video
- Built with Visual Basic and Direct X
- Various views are starting to operate


SILVER Video Authoring
File View
Project
surfin.mov
undersea.mov
hi001.wav
hi013.wav
fishmany.JPG
fishone.JPG
Outline
Introduction
surfin.mov
hi001.wav
surfin.mov
Part I: Underwater L
undersea.m
fishone.JPG
Storyboard
Start
surfin.mov
undersea.mov
hi001.wav
Monitor
Tab Subject View
Introduction
Part I: Underwate
surfin.mov
hi001.wav
surfin.mov
Timeline
:00
0:00:20
0:00:40
Video
Audio

Conclusions

- The job isn't over when the user *finds* the relevant material
- Support for *authoring* is also required
- Re-use and re-purposing of material
  - Reports, summaries, new compositions
- Easy-to-use multi-media editing is crucial

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Supported by NSF Grant IIS-9817527
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Not Used

Editing Capabilities

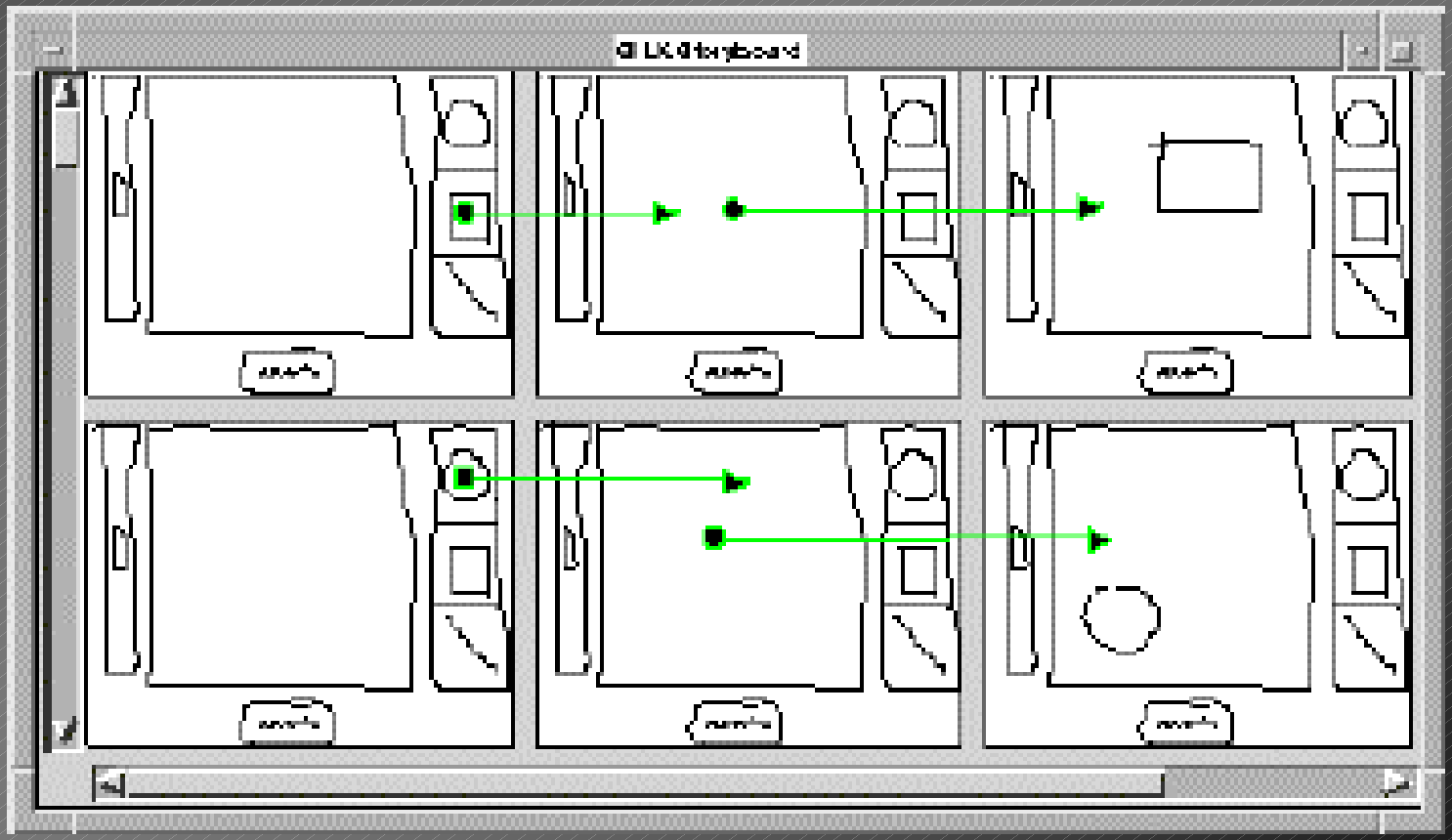
- Not recreating commercial products
- Transcript of audio from or Informedia's recognition or script
- "Higher-level" operations
  - Select segments
  - Selecting in audio or video selects *appropriate* part of other
- Search in the current composition
  - Either for audio or video

Organizing Source Material

- Informedia's visualizations
- Piles
- Hierarchies
- Others from the editing views

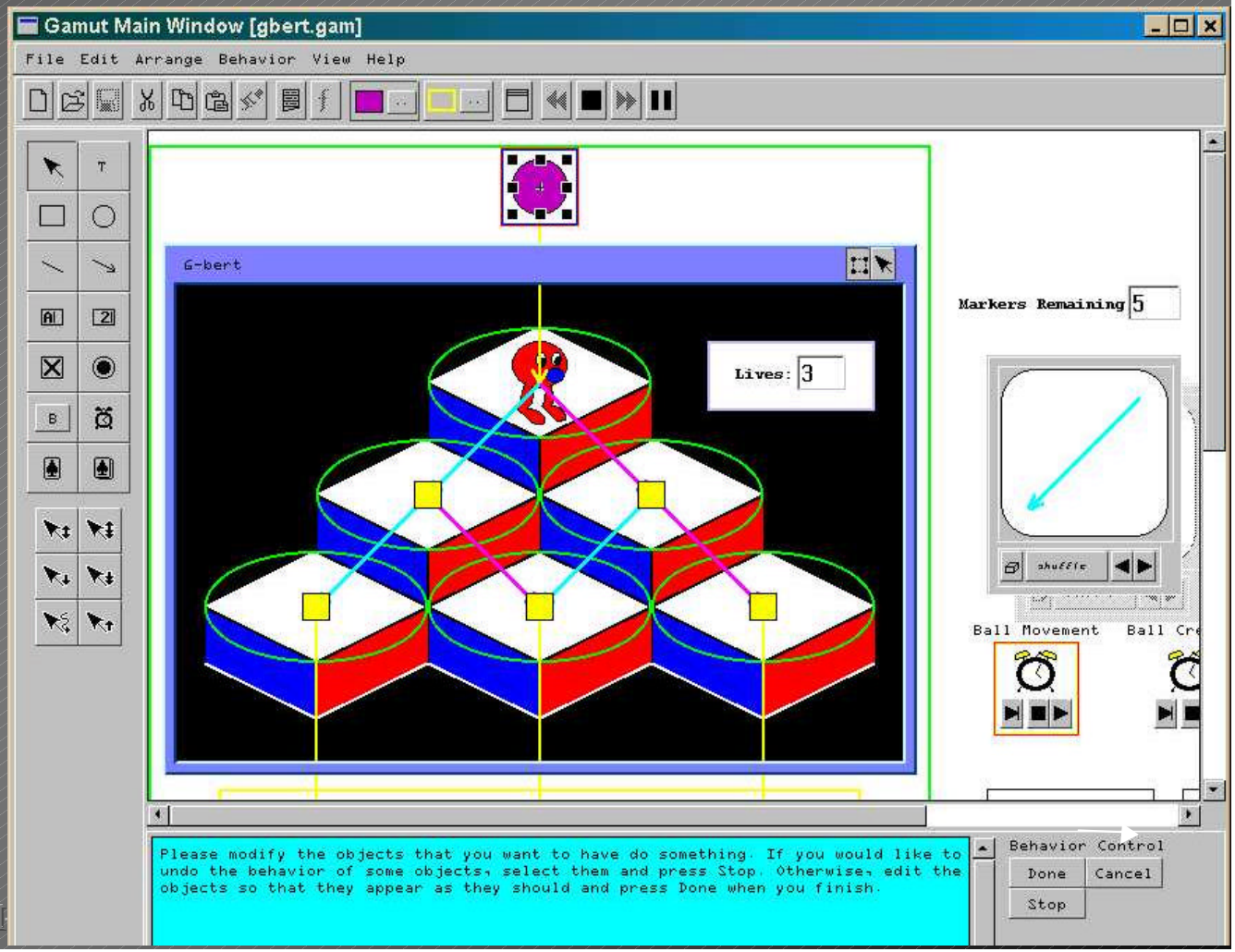
Storyboard from Silk

- Ph.D. of James Landay
- Sketch scenes and draw links



Gamut Behaviors by Example

- Ph.D. of Richard McDaniel
- Infers complex behaviors from multiple examples



Some Results

- **Rule-based style**

  "If PacMan loses all his lives, its game over."

  – **Some use of Constraint style:**

  "Pacman cannot go through a wall."

- **Set operations instead of iterations**

  "When PacMan eats all of the dots, he goes to the next level."

— These tend to eliminate control structures

More Results

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Debugging Tools

- Intelligent assistance
- Heuristic Critics
  - Embody “rules-of-thumb” for video editing
  - People are taught rules of textual grammar, but not for visual media
  - Like the “squiggly underlines” in Word
  - Example: don’t cut during a pan
  - Use Informedia’s information about segments